MIRAK™ 4-Place Stirrers and Stirring Hot Plates

OPERATION MANUAL AND PARTS LIST

SERIES 846, 847

Model #	Voltage	Description
S73130	240	12x12
S73130-26	220-240	12x12
S73134	100	12x12
S73135	120	12x12
SP3230	240	12x12
SP73230-26	220-240	12x12
SP73235	120	12x12
SP73235-60	120	12x12
SP73238	208	12x12
SP73238-60	208	12x12

LT847X2 • 5/28/99

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Safety Information

Alert Signals

Warning
Warnings alert you to a possibility of personal injury.

Caution
Cautions alert you to a possibility of damage to the equipment.

Note
Notes alert you to pertinent facts and conditions.

Hot Surface
Hot surfaces alert you to a possibility of personal injury if you come in contact with a surface during use or for a period of time after use.

Your Thermolyne MIRAK™ 4-Place stirring hot plate has been designed with function, reliability and safety in mind. It is the user's responsibility to install it in conformance with local electrical codes.

This manual contains important operating and safety information. The user must carefully read and understand the contents of the manual prior to the use of this equipment.

Warnings

To avoid electrical shock, always:

1. Use a properly grounded electrical outlet of correct voltage and current handling capacity.

2. Disconnect from the power supply prior to maintenance and servicing.

To avoid personal injury:

1. Do not use in the presence of flammable or combustible materials; fire or explosion may result. This device contains components which may ignite such materials.

2. Keep top surface clean. Use a non-abrasive cleaner. Alkali spills, hydrofluoric acid spills or phosphoric acid spills may damage top and lead to thermal failure. Unplug unit and remove spills promptly. Do not immerse unit for cleaning.

3. Replace the top immediately if damaged by etching, scratching or chipping. A damaged top can break in use.

4. Do not remove or modify grounded power plug. Use only properly grounded outlets to avoid shock hazard. Not rated for use in hazardous atmospheres.

5. Use caution when heating volatile materials; top surface and element can reach the “Flash Point Temperature” of many chemicals. These stirrers and stirring hot plates are not explosion proof. Fire or explosion may result. Unit contains components which may ignite such materials.

6. Use appropriate hand and eye protection when handling hazardous chemicals.

7. Caution: Hot Surface. Avoid Contact. The hot plate will remain dangerously hot with no visible indication for some time after use.

8. Do not use in highly corrosive atmospheres; corrosive fumes and spill may damage top and internal components, creating a shock hazard.

9. Refer servicing to qualified personnel.

Caution
Space unit 12 inches away from combustible materials under any conditions.

Gross weight of items placed on top of 12”x 12” stirrers and stirring hot plates should not exceed 30 lbs.

Please note the following WARNINGS:

Warning

This warning is presented for compliance with California Proposition 65 and other regulatory agencies and only applies to the insulation in this product. This product contains refractory ceramic, refractory ceramic fiber or fiberglass insulation, which can produce respirable dust or fibers during disassembly. Dust or fibers can cause irritation and can aggravate preexisting respiratory diseases. Refractory ceramic and refractory ceramic fibers (after reaching 1000°C) contain crystalline silica, which can cause lung damage (silicosis). The International Agency for Research on Cancer (IARC) has classified refractory ceramic fiber and fiberglass as possibly carcinogenic (Group 2B), and crystalline silica as carcinogenic to humans (Group 1).

The insulating materials can be located in the door, the hearth collar, in the chamber of the product or under the hot plate top. Tests performed by the manufacturer indicate that there is no risk of exposure to dust or respirable fibers resulting from operation of this product under normal conditions. However, there may be a risk of exposure to respirable dust or fibers when repairing or maintaining the insulating materials, or when otherwise disturbing them in a manner which causes release of dust or fibers. By using proper handling procedures and protective equipment you can work safely with these insulating materials and minimize any exposure. Refer to the appropriate Material Safety Data Sheets (MSDS) for information regarding proper handling and recommended protective equipment. For additional MSDS copies, or additional information concerning the handling of refractory ceramic products, please contact the Customer Service Department at Barnstead|Thermolyne Corporation at 1-800-553-0039.

Please read all the information in this manual before operating the unit.

Warning
Refer servicing to qualified personnel.

Introduction

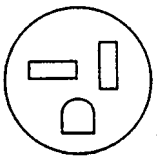
Your Thermolyne MIRAK™ 4-place stirrer or stirring hot plate is a general purpose stirring or stirring and heating plate designed for laboratory procedures requiring precise control of temperature and/or stirring speed. Each 4-place MIRAK model includes a digital display for monitoring actual stirring speed, and the stirring hot plate models have dual displays so temperature and stirring speed can be monitored simultaneously. The 4-place stirring hot plate is capable of producing accurately controlled temperatures from 40°C through 540°C on all 208 volt and 240 volt models. 120 volt models have a temperature range of 40°C to 370°C. The temperature may be controlled at the plate surface by internal Type K thermocouple sensor, or the solution temperature may be controlled utilizing an accessory ungrounded Type K thermocouple probe. A 6” or 10” general purpose stainless steel immersion probe or chemical-resistant 7” solid Teflon® immersion probe may be ordered separately. The stirrer will accurately maintain stirring speeds from 60 rpm up to 1200 rpm. On stirring hot plate models, the accessory probe may also be utilized to display the actual temperature of heat-sensitive solutions during stirring-only functions. The top plate on the MIRAK 4-place units is solid ceramic and is suitable for use with glass or metal vessels.

Your MIRAK 4-place stirrer or stirring hot plate may be used for general purpose heating applications and/or general laboratory mixing of solutions including; sample preparation, heating reagents, melting paraffin, warming resinous chemicals, content analysis, solvent evaporations, digestions, media preparation and sterilization, titrations, sand baths and microscale chemistry applications.

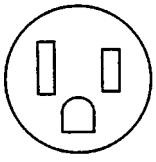
Unpacking

Note
A special 20-amp cordset is included on the CSA-approved model of the 12” x 12” 120 volt MIRAK 4-place stirring hot plate (SP73235). This 20-amp cordset can only be plugged into a non-standard 20-amp, 120 volt wall receptacle. If you do not have the appropriate receptacle, contact a qualified electrician for installation of a 20-amp 120 volt outlet.

A 12” x 12” 120 volt MIRAK 4-place stirring hot plate (SP73235-60) is available with a standard 15-amp, 120 volt cordset.This model is not CSA-approved.



20-amp, 120 volt



15-amp, 120 volt

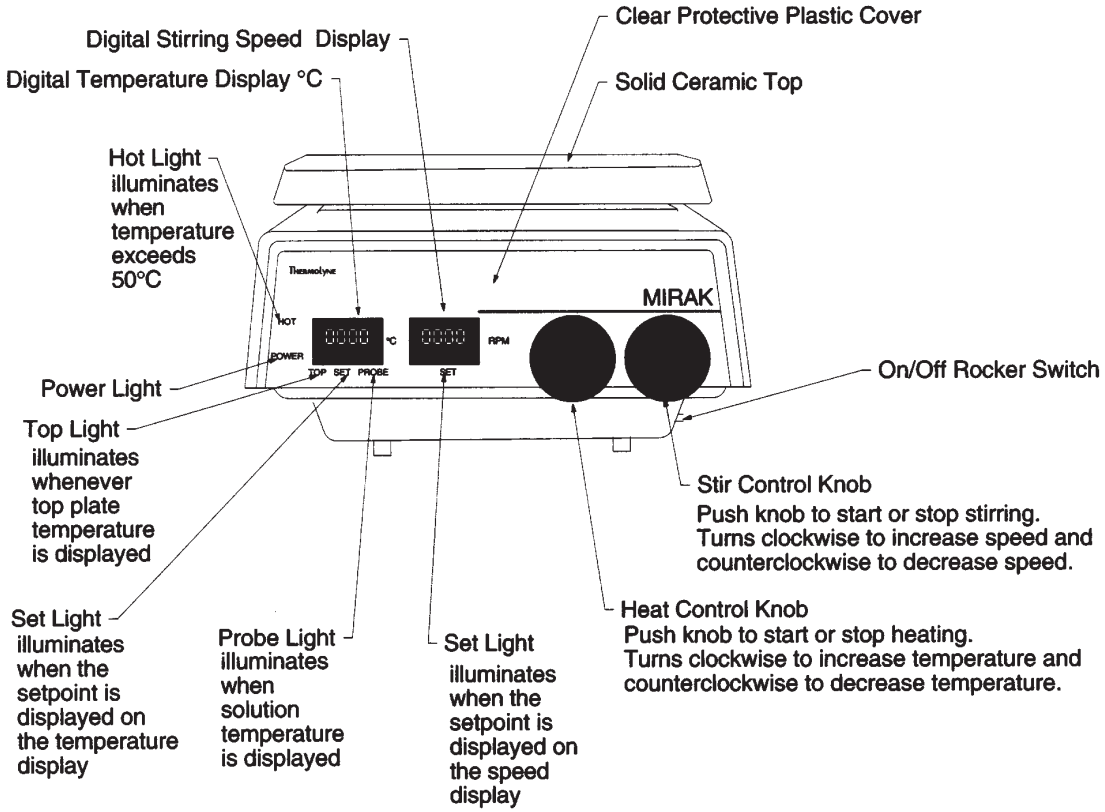
1. Remove your MIRAK 4-place stirrer or stirring hot plate from the carton.
2. Inspect to ensure that the unit has not been damaged during shipment.
3. If the unit appears to have sustained shipping damage, contact the distributor from whom you purchased this product or call Barnstead|Thermolyne Customer Service at 800-553-0039.
4. Remove the packaging from underneath the top plate by gently pulling the packaging material toward you.

Installation

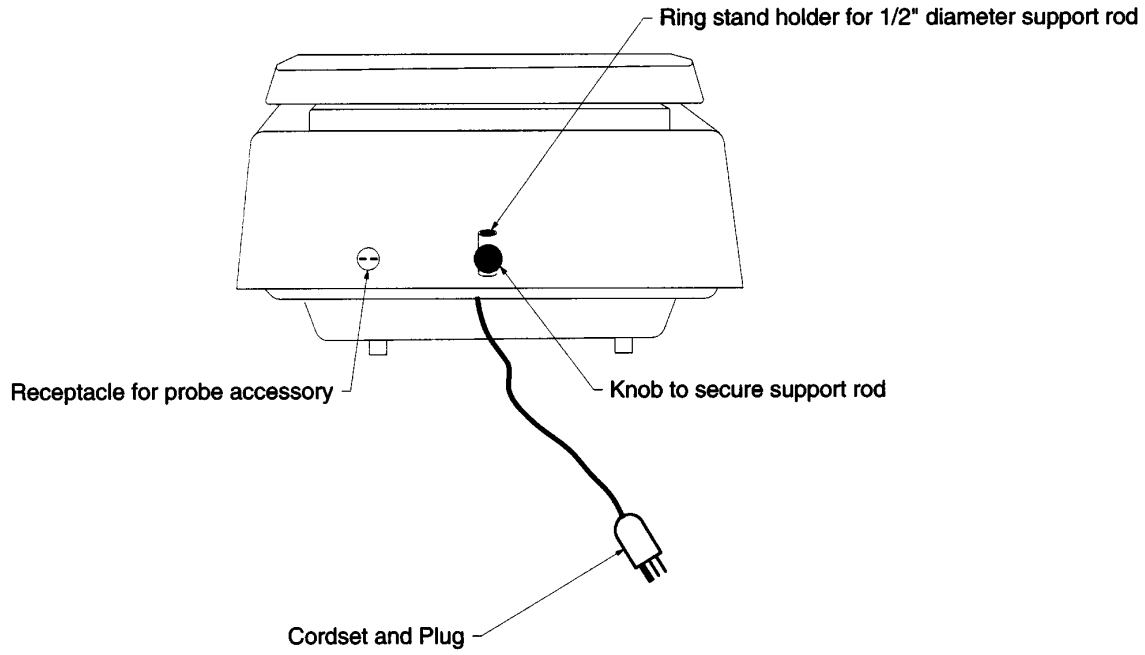
1. Set the unit on a flat, stable surface at least 12” away from combustible materials and plug the cordset into a properly grounded electrical outlet of correct voltage and current handling capacity

2. Use your right hand to locate the ON/OFF power switch which is on the side, near the front right corner as you face the unit.

3. Press the black ON/OFF power rocker switch to the ON position. The red LED display(s), and the green power light to the left of the display(s) should illuminate. The unit is ready for operation.


Digital Stirring Speed Display
Digital Temperature Display °C
Clear Protective Plastic Cover
Solid Ceramic Top
Hot Light illuminates when temperature exceeds 50°C
MIRAK
HOT
POWER
TOP SET PROBE
SET
RPM
Power Light
Top Light illuminates whenever top plate temperature is displayed
On/Off Rocker Switch
Stir Control Knob
Push knob to start or stop stirring. Turns clockwise to increase speed and counterclockwise to decrease speed.
Heat Control Knob
Push knob to start or stop heating. Turns clockwise to increase temperature and counterclockwise to decrease temperature.
Set Light illuminates when the setpoint is displayed on the temperature display
Probe Light illuminates when solution temperature is displayed
Set Light illuminates when the setpoint is displayed on the speed display

Front View


Ring stand holder for 1/2" diameter support rod
Receptacle for probe accessory
Knob to secure support rod
Cordset and Plug

Back View

Principles of Operation

Each MIRAK unit utilizes the latest in microprocessor technology to deliver the most reliable, accurately controlled, ceramic top hot plate, stirrer and stirring hot plate on the market.

Your MIRAK 4-place 240 volt and 208 volt stirring hot plate has an electronic closed loop feedback control which will accurately maintain temperature setpoints from 40°C to 540°C. The 120 volt MIRAK 4-place stirring hot plate will maintain temperature setpoints from 40°C - 370°C. The top plate surface temperatures are calibrated and verified at the factory using the latest in infrared temperature measurement. The measurements are made with an infrared meter mounted approximately 26” above the top surface of the hot plate or stirring hot plate. If the temperature measurement of the ceramic top is made with measurement devices other than the infrared, the error of the measuring technique may be greater than the error of the unit.

The MIRAK stirring Hot Plate units use an ungrounded Type K thermocouple for measuring both the top plate temperature and the solution temperature when using the probe. Both top plate surface and probe temperature are measured with independent analog circuits. This provides a significant increase in certain types of metal vessels and sandbaths on the MIRAK without damaging the ceramic top. However, we recommend that you do not control the temperature with a probe when heating a metal vessel or a sandbath.

The electronic stirring speed control on 4-place MIRAK units will maintain the speed setpoint when the unit is loaded at ±4 rpm as displayed by the LED display on the unit. There are four

individual motors in the MIRAK 4-place stirrers and stirring hot plates which produce maximum stirring torque under normal laboratory load conditions. Each motor is combined with a powerful magnet to provide exceptional magnetic coupling with a stirbar. Each motor is centered beneath each of the four stirring positions indicated by the circles silkscreened on the 12” x 12” top plate. All four motors will operate at the same speed.

Operation

Removing the Clear Plastic Cover

Your MIRAK unit has a protective plastic cover over the front control panel. This plastic cover is designed to protect the control knobs and the display panel from spills, and should remain in place when the unit is being used. To use the knob(s) while the plastic cover is in place, spin the knob(s) from the bottom where the knob projects below the plastic cover. This plastic cover can be easily removed for cleaning by grasping the cover at each bottom corner and gently pulling the sides of the plastic cover away from the case while lifting the cover toward you. To replace the cover simply slide it back onto the case.

The Power Switch

Your MIRAK unit has a separate ON/OFF power switch which is a black rocker switch located on the lower front corner of the right side as you’re facing the unit. This separate power switch allows you to turn your MIRAK hot plate, stirrer or stirring hot plate on or off without disturbing your temperature and/or speed setting. Your last setpoint will be held in memory even if the unit is unplugged and will reappear on the display as soon as the unit is powered up again.
Whenever the power is on, a green power light illuminates on the front control panel.

Setting the Stirring Speed

The 12” x 12” top plate will accommodate up to four 1 liter vessels, one at each stirring position. The 4-place MIRAK will also stir two 2 liter flasks simultaneously with up to two 1 liter flasks, one at each of the other two stirring positions. Actual stirring speed may differ between larger vessels and smaller vessels stirred simultaneously, depending on the amount and the viscosity of the solution in each flask.

Your MIRAK 4-place stirrer or stirring hot plate has an electronic feedback speed control which will maintain a precise speed setpoint from 60 rpm to 1200 rpm with accuracy of ±2 rpm. Maximum speed at each position is dependent on viscosity of the solution and/or the amount of solution in each vessel. The MIRAK stirrers and stirring hot plates are equipped with a strong magnet and high torque motor which will draw a vortex in up to 1800 ml of water stirred in a 2 liter flask with a new 2” stir bar.

To set the speed, spin the SPEED CONTROL knob until your desired setting is indicated on the digital display. As you move the knob, the SET light next to the RPM display will illuminate. Turn the knob clockwise to increase the speed or counterclockwise to decrease the speed. The unit will not start to stir until you press the speed control knob. Once the unit begins stirring, the display will register ACTUAL speed and the SET light will no longer be illuminated. To check your setpoint, move the knob counterclockwise one position. You will feel a click, the SET light will illuminate and your setpoint will be displayed again for five

seconds. After five seconds the display will automatically return to indicating actual speed and the SET light will go out. To stop the stirring action without changing your setpoint, press the knob once. To resume stirring at the set speed, press the knob again.

If you want to ensure that the unit will not start to stir if the knob is inadvertently pressed, turn the speed control knob until the display indicates the word OFF.

Setting the Temperature

Your MIRAK 4-place stirring hot plate has an electronic closed-loop feedback control which will accurately maintain temperature setpoints from 40°C through 540°Con the 240 volt and 208 volt models. The 240 volt 4-place stirring hot plates will maintain temperatures from 40°C through 370°C. An unloaded stirring hotplate will heat to maximum temperature in just 8 minutes. A HOT light on the front panel will illuminate whenever the top surface temperature exceeds 50°C. The temperature may be controlled either at the top plate by the internal Type K thermocouple sensor, or in the solution using an accessory ungrounded Type K thermocouple probe. (A 6” or 10” stainless steel general purpose

Stirring Speed Guide

Unit	Flask Size	Stirbar Size	Amount of Solution	Viscosity	Maximum Speed*
4-place MIRAK	1 liter	2”	800 ml	water	1200 rpm
4-place MIRAK	2 liter	2”	1800 ml	water	1200 rpm
4-place MIRAK	1 liter	2”	1000 ml	cooking oil	700 rpm
4-place MIRAK	500 ml	2”	350 ml	30 wt. motor oil	1100 rpm

* Maximum speed obtained without the stir bar loosing coupling with the magnet.
(For speed stability and display accuracy please refer to the Operating Specifications.)

immersion probe or a chemical-resistant 7” Teflon immersion probe are available through you distributor, or by contacting Barnstead|Thermolyne at 800-553-0039.) Your MIRAK 4-place stirrer or stirring hot plate will accept any ungrounded Type K thermocouple probe, however, the accuracy of probes other than those we’ve tested and specified may exceed the probe accuracy rating we’ve designated.

Note
The temperature display will not indicate a temperature less than 40°C. If the actual temperature is less than 40°C, the word LO will be indicated until the actual temperature reaches 40°C.

Your MIRAK 4-place stirring hot plate will display the temperature in °C. The display will always indicate OFF or your last setpoint, and the SET light will be illuminated until you press the heat control knob to initiate operation. Once the heat control knob has been pressed, the ACTUAL temperature of the top plate or the probe will be displayed and the SET light will no longer be illuminated. If you want to check your setpoint, you do not have to press the knob again; simply turn the knob counterclockwise one click. Your setpoint will be displayed for approximately five seconds until the display returns to indicating the actual temperature.

Warning
Caution: Hot Surface. Avoid Contact. The hot plate will remain dangerously hot with no visible indication for some time after use.

A single element covers the entire surface of the 12” x 12” top plate and supplies even heat to the entire surface. A single large vessel or numerous smaller vessels can be heated anywhere on the top plate when the stirring function is not in use. Vessels to be heated only do not have to be located at the center of each silkscreen position.

If you want to ensure that the unit will not heat if the knob is inadvertently pressed, turn the temperature control knob until the display indicates the word OFF.

Controlling Top Plate Temperature

Your MIRAK 4-place stirring hot plate will control the top plate, and the display will indicate top plate temperature WHENEVER THE PROBE IS NOT PLUGGED IN. When the unit is displaying the top plate temperature the word TOP on the front panel will be illuminated.

Note
The top plate temperatures will be higher than your solution temperature.

Warning
If the probe is plugged into your 4-place stirring hot plate while the heat control is operating but is not in solution, the temperature display will continue to indicate an ambient temperature. Because the setpoint cannot be reached, the element will continue to supply heat to the top plate, and the maximum top plate temperature of 540°C may be reached.

When using the probe accessory, make sure the probe is always in the solution when the heat control is operating. (Any Type K thermocouple used must be an ungrounded type.

Note
The top plate temperature will not exceed 540C.

Controlling Solution Temperature

To control your solution temperature simply plug an ungrounded Type K thermocouple probe into the single probe receptacle located on the back of the unit and place the probe in your solution. The display will indicate the actual temperature of the solution as measured by the probe, and the word PROBE on the front panel will be illuminated.

The solution probe offers more exact temperature control than regulating the top plate by the thermal internal sensor. If you need to maintain a precise setpoint, we recommend using a probe to control the solution temperature instead of controlling the top plate temperature.

When using a probe with your MIRAK 4-place stirring hot plate, it is recommended that you use a clamp on a support rod to hold the probe in your solution.

To ensure accurate probe readings, as much of the probe sheath as possible should be immersed in your solution.

To obtain an accurate reading when you are using the probe and stirring your solution, make sure the probe is immersed in the liquid and is not located in air in the center of the stirring vortex.

Using the Probe with the Temperature Display for Stirring-only Applications

On the stirring hot plate model, the probe can also be utilized to monitor the actual temperature of your solution when you want to stir the solution without heating. To use the probe without heating the solution, turn the knob until the display indicates OFF and press the knob to initiate operation. The element will not supply heat to the hot plate. The display will indicate LO if your solution temperature remains at less than 40°C, or the actual temperature of your solution if it is above 40°C.

To Achieve Fast Heat-up of Large Volumes

With a Probe

When heating large volumes of solution, preheat the top plate at maximum temperature to allow the plate to heat the solution quickly before plugging your probe into the probe receptacle in the back of the unit. As the top plate heats, monitor your solution temperature with a standard laboratory thermometer until your solution is approximately 15° below your

desired setpoint. Now plug your probe into the unit, change the setpoint to your desired solution temperature, and place the probe in your solution.

Note
If you allow the top plate to reach the maximum temperature of 540°C while preheating and then turn the control down to a setpoint less than 200°C, the temperature of the top will drop rapidly to 200°C. Because of the natural cooling characteristics of ceramic, the temperature of the top will drop much more gradually after the top plate temperature reaches 200°C.

Without a Probe

If you are heating larger volumes and do not intend to use the probe to maintain a precise solution temperature, faster heating can be achieved by turning the heat control knob to maximum temperature until the solution starts to heat, and then turning the setpoint back to your desired top plate temperature.

Heating Small Volumes

To heat small volumes quickly it should not be necessary to preheat the solution at a higher temperature. By not preheating small volumes you avoid the potential for the temperature to overshoot your desired setpoint. If you plan to control the solution temperature of a small volume sample with the probe, initiate heating with the probe in the solution; no preheating should be required.

Heating Metal Vessels and Sand Baths

Metal vessels and sand baths cannot be heated on most solid ceramic tops because of the tendency for the metal and the sand to reflect heat back into the top, eventually exceeding the maximum temperature rating for a ceramic top, which causes it to break. Because the advanced electronic control in the MIRAK is capable of precisely regulating the top plate

temperature, metal vessels and sand baths may be heated safely without the danger of the ceramic top breaking.

When heating metal vessels and sand baths however, we recommend that you DO NOT use the probe to control the temperature. Because of the heating and cooling properties of metal and sand, the sample temperatures fluctuate, which will result in unstable top plate temperatures. We achieved better results controlling the top plate temperature, which allowed us to maintain a constant level of heat to the sand bath or metal vessel. The top plate setpoint should be set approximately 100° above the temperature required for your sample, and the sample temperature may be monitored with a standard laboratory thermometer.

Heat-up Time Guide

Unit	Temperature Setpoint	Flask Size	Amount of Solution	Time to Vigorous Boil
12” x 12” 120 volt MIRAK	540°C	1 liter	1000 ml (water)	26 min.
12” x 12” 120 volt MIRAK	540°C	2 liter	1800 ml (water)	32 min.
12” x 12” 120 volt MIRAK	540°C	4 liter	4000 ml (water)	46 min.
12” x 12” 120 volt MIRAK	540°C	1 liter	1000 ml (water)	17 min.
12” x 12” 120 volt MIRAK	540°C	2 liter	1800 ml (water)	21 min.
12” x 12” 120 volt MIRAK	540°C	4 liter	4000 ml (water)	25 min.

Operating Specifications

Top Plate Surface	Solid Ceramic
Heating Specifications	Temperature range: 40°C - 540°C
Heat-up time to maximum temperature (unloaded top plate)	8 minutes
Temperature stability at plate surface (@ 70°C)	± 2.0°C

Stability of the solution temperature (400 ml of water in a 1000 ml glass flask):

Controlled by the top plate at 70°C setpoint (solution maintained at 30°C)	± 1.0°C
Controlled by the immersion probe at 70°C setpoint (solution maintained at 70°C)	± 1.0°C
Accuracy of the temperature display vs. the actual temperature of the hot plate (setpoint 70°C). Top plate temperature was verified with an infrared meter mounted approx. 26” above the top plate surface	± 1.0°C
Accuracy of the temperature display vs. the actual solution temperature as measured by the stainless steel or Teflon immersion probe (setpoint 70°C)	± 1.5°C

Stirring Speed Specifications

Speed range (maximum speed is dependent on the viscosity of the solution)	60 - 120 rpm
Stability of the stirring speed setpoint (600 ml of water in a 1000 ml glass flask)	± 4.0 rpm
Accuracy of the speed display with the actual stirring speed	± 2.0 rpm

Top Plate Size	Max. Recommended Flask Size	Max. Weight on Top Plate
12” x 12”	2 liters*	30 lbs.
12” x 12”	6 liters**	30 lbs.

* A maximum of two 2 liter flasks can be accommodated on the 12” x 12” top plate when the stirring function is in use. Up to two 1 liter flasks can be accommodated simultaneously at the other two stirring positions.

** A maximum of one 6 liter flask can be accommodated on the stirring hot plate when heating only.

General Operating Specifications

Dimensions - 12” x12” models

Model Numbers	SP73235 SP73235-60 SP73230 SP73230-26 SP73238 SP73238-60	 S73135 S73130 S73130-26 S73134
Overall Width	13.500 (34.29)	13.500 (34.29)
Overall Height	6.750 (17.15)	6.438 (16.35)
Overall Depth	16.625 (42.23)	16.625 (42.23)
Top Plate Width	12.375 (31.43)	12.375 (31.43)
Top Plate Height		
Top Plate Depth	12.375 (31.43)	12.375 (31.43)
Weight lbs. (kg)	25.74 (11.68)	22.13 (10.04)

Electrical Ratings - 12”x 12” Models

Model No.	Volts	Amps	Watts	Freq.	Phase
S73130	220-240	0.58	75	50/60	1
S73130-26	220-240	0.58	75	50/60	1
S73135	120	1.50	100	50/60	1
SP73230	220-240	12	3175	50/60	1
SP73230-26	220-240	12	3175	50/60	1
SP73235	120	15.0	1720	50/90	1
SP73235-60	120	15.0	1720	50/60	1
SP73238	208	14.5	2972	50/60	1
SP73238-60	208	14.5	2972	50/60	1

Temperature Range for Hot Plates and Stirring Hot Plates

104°F - 1004°F (40°C - 540°C)
Exception: 120 volt 4-place models - maximum temperature 698°F (370°C)

Stirring Speed Range for 4-place Stirrers and Stirring Hot Plates

60 -1200 rpm

Environmental Parameters for all Units

Ambient Temperature: 17°C - 27°C (63°F - 81°F) Exception: stirrers; see note.
Relative Humidity: 20% - 80% (non-condensing)

Note

12” x 12” 4-place stirrers are suitable for use in a 37°C non-condensing incubator or in a cold room at -4°C.

Maintenance and Servicing

Warning
Disconnect from the power supply prior to maintenance and servicing.

Refer servicing to qualified personnel.

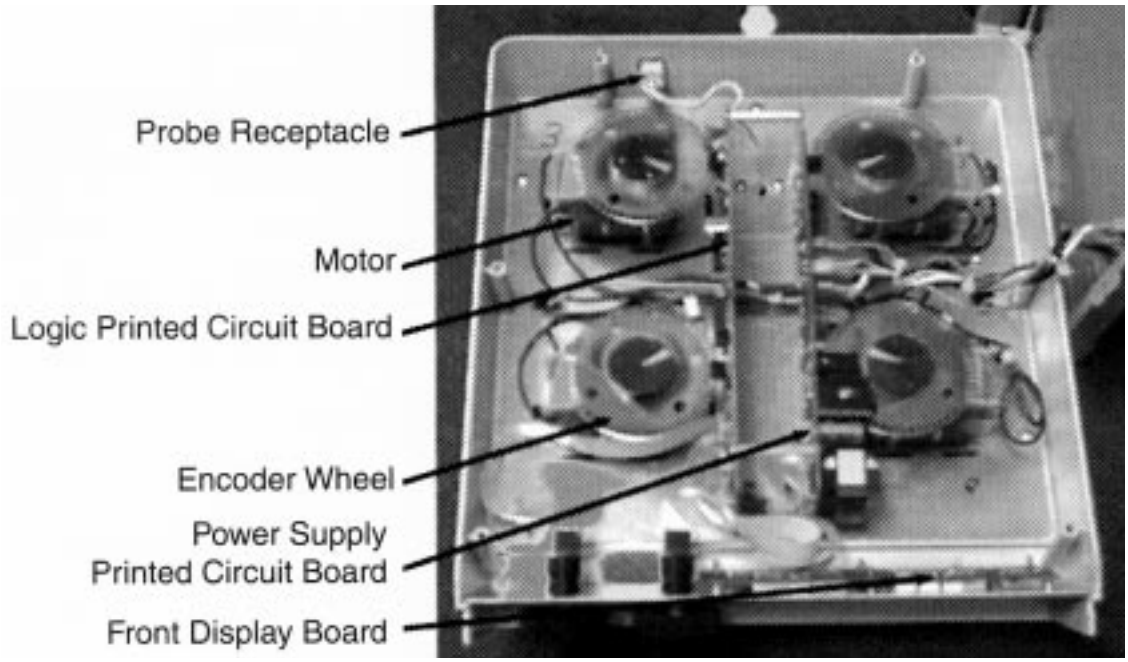
Replacing the Power Board and or the Logic Board

1. Unplug unit, turn unit upside down and remove screws from bottom.

2. Open unit. Locate power board and logic board (see photo).

3. The power board and the logic board will have to be removed together as a set by unscrewing the metal bracket attaching the two boards to the bottom metal plate. In order to gain access to the power and logic boards, it is necessary to remove the front display panel of the unit.

4. Remove the cables from the display board.



MIRAK Interior

5. Note the position and color of wires and cable connected to the power/logic board assembly, paying particular attention to the position of the black wires connecting each of the four stirring motors to the boards.

6. Disconnect wires attached to the power/logic board assembly. If you have a stirrer skip to step 9.

7. On stirring hot plate models note the position of the wires running from the thermocouple for the top plate. Remove these wires from the logic board.

8. Gently pull both power board/logic board assembly 3-4” to gain access to the lower thermocouple wire for the external probe. Detach this thermo-couple wire.

9. At this point you can remove either the logic board or the power board from the assembly by removing the screws which secure both boards to the metal bracket running between the two boards, and to the support posts.

10. Replace either the power board or the logic board and reassemble the board to the support posts, and to the metal bracket running between both boards.

11. If you have a stirring hot plate model, slide the assembly in place and secure the four screws which mount the bracket for the board assembly to the metal plate.

12. Position the power/logic board assembly in place and secure the four screws which mount the bracket for the board assembly to the metal plate.

13. Reconnect all wires and cables and reassemble the front display panel.

14. If the logic board was replaced, locate the jumper wire at position J3 on the logic board and move this jumper wire to position J5 on the logic board.

15. Proceed to the set-up procedure. (This procedure is not necessary if only the power board was replaced, and is also not necessary when replacing the logic board in stirrers.)

Replacing the Display Board

1. Unplug unit, turn unit upside down and remove screws from bottom.

2. Open unit. Locate display board behind the front panel of the unit.

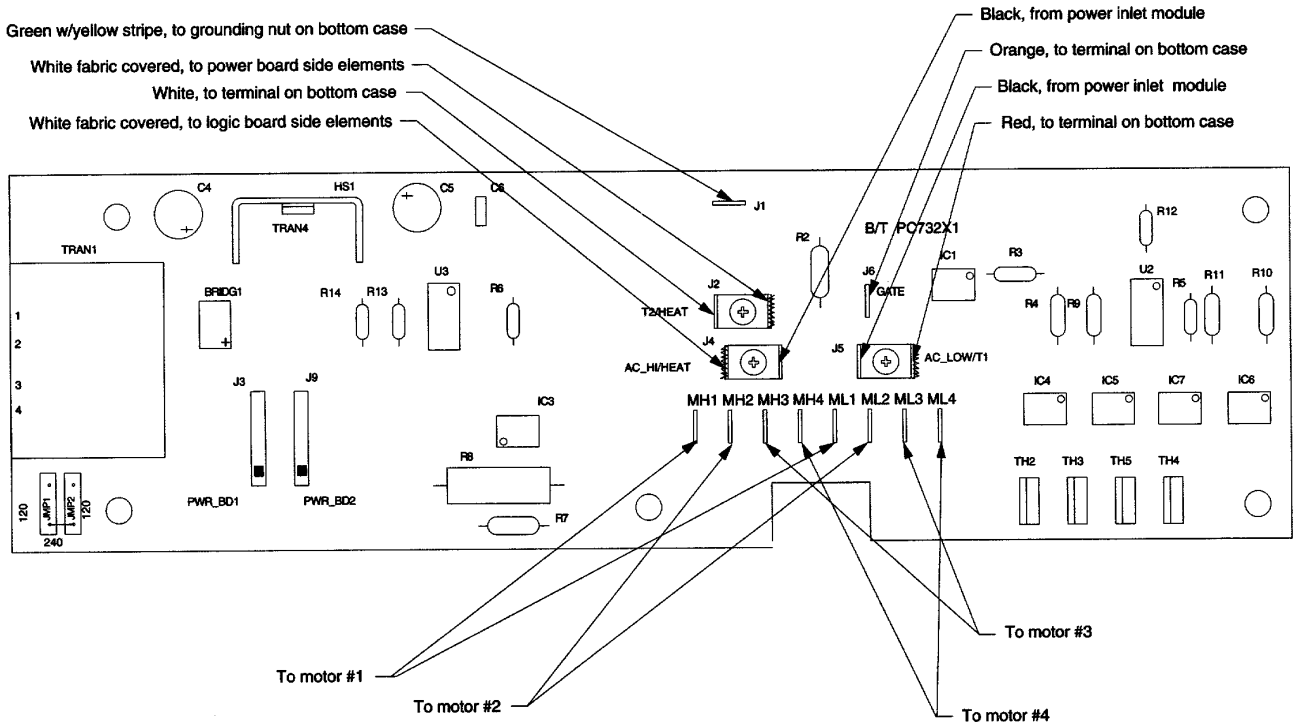
3. Note the position of the blue stripe running along the bottom of the cable connected to the board.

4. Disconnect the cable from the board.

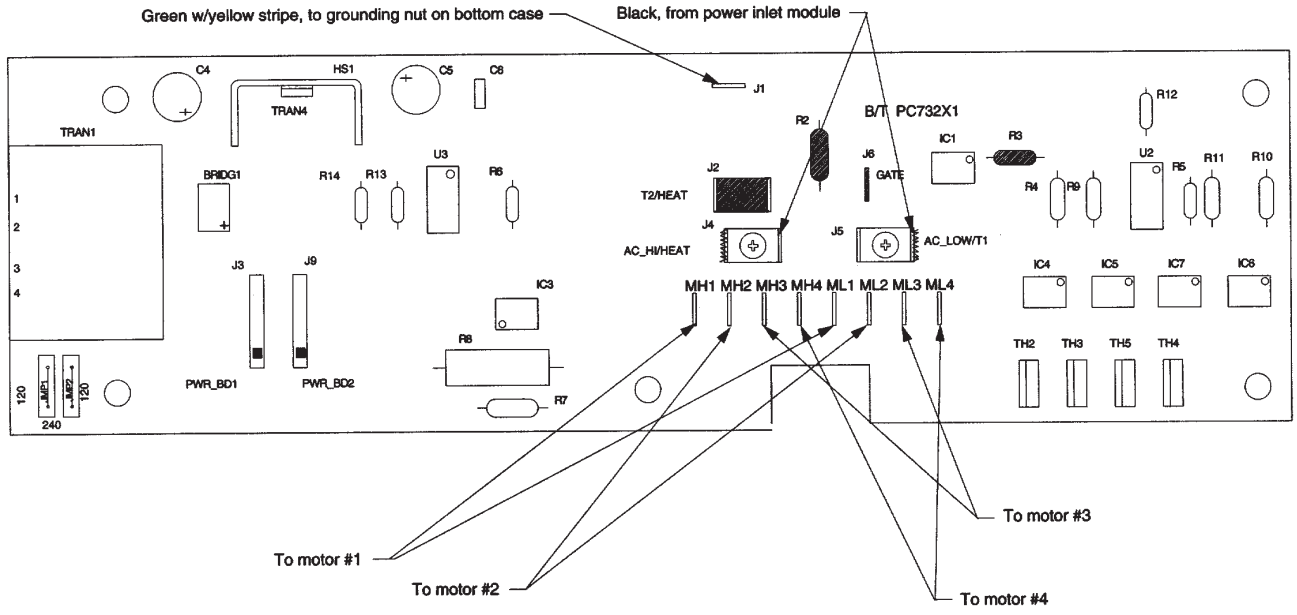
5. Loosen the nuts and remove board from front panel.

6. Replace board, reconnecting cable as noted in step 3. *Correct positioning of blue stripe on cable is important for proper functioning.*

7. Replace the bottom and secure it with screws.



Power Board for stirring hot plate detailing correct placement of wires and cables



Power Board for stirrer detailing correct placement of wires and cables

Replacing the Motors

1. Unplug unit, turn unit upside down and remove screws from bottom.

2. Open unit. Note position and color of wires and cables connected to the logic, power and display boards.

3. Remove the display board as noted in steps 3 through 5 under “Replacing the Display Board.”

4. Remove the logic and power board assembly as noted in steps 5 through 8 under “Replacing the Power and/or Logic Boards.” (It is not necessary to remove the power board or the logic board from the metal bracket and the support posts they are mounted to.)

5. Remove the encoder wheel from the motor which you intend to replace by loosening the hex screw. (Refer to photo and exploded view.)

6. Unclip the bundle of wires. If you have a stirring hot plate proceed with step 7. If you have a stirrer skip to step 11.

7. Remove the two fiberglass insulated heating ELEMENT wires from the power board.

8. Note the lower heating ELEMENT wire which runs underneath the power board/logic board assembly. Pull this element wire free from underneath the board assembly.

9. Locate the upper THERMOCOUPLE

wires coming from the probe receptacle at the back of the unit and disconnect these wires from the logic board.

11. Remove the 6 screws which secure the metal plate to the case.

12. Pick up the whole metal plate assembly with the power board/logic board assembly still attached. If you have a stirring hot plate model, carefully thread the element wires through the holes in the metal plate.

13. Flip the plate over.

14. Note the distance of the magnet assemblies from the baffle plate underneath the top plate assembly.

15. Remove the magnet assembly from the motor you will be replacing.

16. Remove the two screws holding the motor and replace the motor.

17. Replace the magnet assembly, maintaining the proper distancing from the baffle plate.

18. Flip the plate over. If you have a stirring hot plate model, make sure the element wires are threaded back through the holes in the metal plate. Reinsert screws and tighten the metal plate to the case.

19. Reattach the encoder wheel on the motor which was replaced. Adjust the encoder wheel on the shaft until it freely rotates, and then tighten the hex screw.

20. Screw the bracket with the logic board/power board assembly back onto the metal plate.

21. Reattach all wires.

22. Replace display board and attach cables.

23. Bundle wires and resecure with tie-straps.

24. Replace bottom and secure with screws.

Replacing the Top Plate Assembly

1. Unplug unit, turn unit upside down and remove screws from bottom.

2. Open unit. Note position and color of wires and cables connected to the logic, power and display boards.

3. Remove the display board as noted in steps 3 - 5 under “Replacing the Display Board.”

4. Unclip the bundle of wires.

5. Remove wiring from power board. (If you have a stirrer skip to step 9.)

6. Note the lower heating ELEMENT wire which runs underneath the power board/logic board assembly. Pull this element wire free from underneath the board assembly.

7. Locate the top plate THERMOCOUPLE wires attached to the logic board. Detach these thermocouple wires from the logic board.

8. Remove the THERMOCOUPLE wires coming from the probe receptacle at the back of the unit and disconnect these wires from the logic board.

9. Locate the screws holding the top plate assembly and attach to the case. You can access the screws through the four holes in the metal plate or remove the metal plate and then unscrew the top plate assembly.

10. Replace top plate assembly and attach to the case.

11. If you removed the metal plate, replace it, making sure the thermocouple and element wires come through the metal plate. Insert screws and tighten the metal plate back into place.

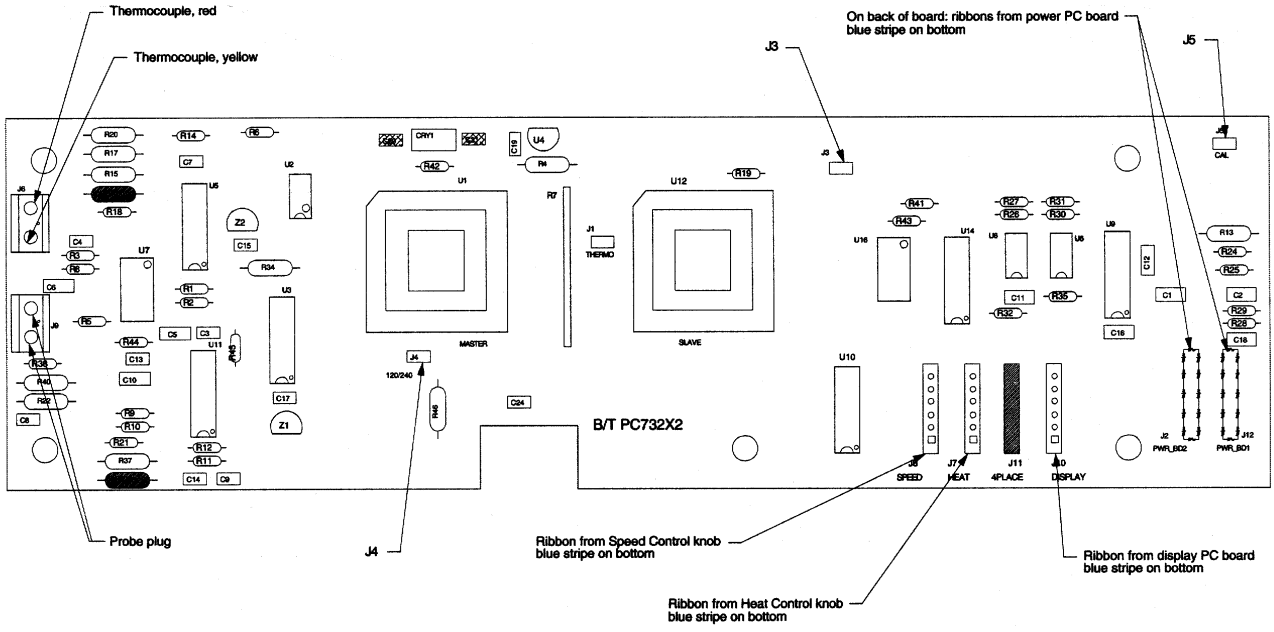
12. Reattach the logic board/power board assembly.

13. Adjust the encoder wheels for each motor so each rotates freely through the optical pick-up slots on the logic board. Each black slot should project no further than the holes in the outer perimeter of each encoder wheel.

14. Reconnect wires and cables to the power/logic board assembly and put the display board back into position, reconnecting cables.

Note
The set-up procedure should be followed whenever the top plate assembly or the logic board is replaced in your MIRAK 4-place stirring hot plate. The set-up procedure is not necessary when replacing the top plate or the logic board in the stirrers.

15. Bundle wires and resecure with a tie-strap.
16. Replace bottom and secure with screws.
17. Proceed to set-up procedure.



Logic Printed Circuit Board

Set-Up Procedure

1. Place a 500 ml flask with 300 ml of water on the top plate. Place a standard laboratory thermometer (do not use the probe for this procedure) 1/2” above the bottom of the flask.

2. Turn the unit on and set the temperature at 70°C. Allow the unit to operate at this temperature for five hours.

3. At the end of five hours note the temperature measurement on the thermometer and subtract 44° from the thermometer reading to determine the absolute value. Write this number down, you may need to refer to it in step 9. If the absolute value is zero ±3, your unit is within tolerance and you do not need to continue. If your number exceeds zero ±3 continue with steps 4 - 13. If the absolute value of this difference is greater than ±20 from zero, return the unit to Barnstead|Thermolyne for evaluation.

4. Turn the unit off, unplug the cordset from the power source and allow the top plate to cool.

5. Once the top plate is cool, turn the unit off and remove the bottom cover. If your unit is a stirring hot plate you should also unscrew the bracket holding the logic board/power board assembly from the metal plate at this time. (Refer to the instructions in this manual for disassembling and removing the logic board.)

6. Locate the black plastic jumper on the logic board at position J3. (See the illustration of the Logic Printed Circuit board.) Remove the jumper and secure it across both pins at position J5. If you cannot locate the jumper, contact Barnstead|Thermolyne.

Note
The temperature display will read 888 and then 000. The PROBE, SET, TOP and HOT lights will all be illuminated.

7. Reattach the logic board bracket on your stirring hot plate model and realign the pickup slot with the encoder wheel (refer to the instructions in this manual for reassembling the logic board with the encoder wheel). Screw the bottom cover back on, plug the unit into the power source and turn the power switch to the ON position.

8. Push the heat knob once. The digit on the far right side of the temperature display will get brighter. This display may read something other than zero. The HOT light may be on or off which indicates whether the number on the display is positive or negative. The number on the display is positive if the HOT light is on and negative if the HOT light is off.

9. Refer to the number (absolute value calculated) that you noted in step 3. If that number was greater than zero + 3, turn the knob CLOCKWISE, counting each click of the knob until you have advanced the knob the same number of positions as the number you calculated in step 3, then turn the knob one additional click. (The knob is is detented so you can feel a click at each one degree position on the knob. Do not turn the knob a full rotation). If the number you recorded in step 3 was more than zero

minus 3, turn the knob COUNTER-CLOCKWISE, counting each click of the knob until you have advanced the knob the same number of positions as the number you calculated in step 3, and then one additional click.

10. Push the heat knob again. The PROBE, SET and TOP lights will no longer be illuminated.

11. Turn the power switch to the OFF position, unplug the cordset from the power source, and allow the top plate to cool completely.

12. Remove the bottom cover again and move the black plastic jumper on the logic board from position J5 to J3.

13. Replace the bottom again. The unit is now within tolerance and no further adjustment is necessary until the top plate assembly or the logic board is removed again.

Calibrating the Probe Temperature Input

To verify the temperature reading of the probe, insert a calibrated thermometer into a solution you are heating on the stirring hot plate. When the thermometer has stabilized, record the temperature readings given by both the thermometer and by the probe as indicated on the MIRAK display.

To calibrate the probe:

1. Unplug unit, turn unit upside down

and remove screws from bottom.

2. Open unit. Locate the logic board. (See illustration of the interior of unit or the exploded view.) Move the jumper position J3 to position J5. For series 732 units, you must remove jumper J4 if it exists.

3. Replace the bottom of the unit and turn the unit over.

4. Calculate the necessary correction for the probe using the following equation:

   Probe Error = (displayed temperature) - (actual temperature measured by other source)

   Correction = 350 - Probe Error (if the error is negative, the correction is >350)

5. Turn the unit on. The display will show “888” and then “000.” The HOT, PROBE, SET and TOP LED’s will be on. Push the heat knob once. The digit on the far right side will get brighter.

6. Turn the heat knob clockwise until the display shows the correction calculated above. Push the heat knob again. The SET, TOP, and PROBE LED’s will go out. The correction will remain on the display.

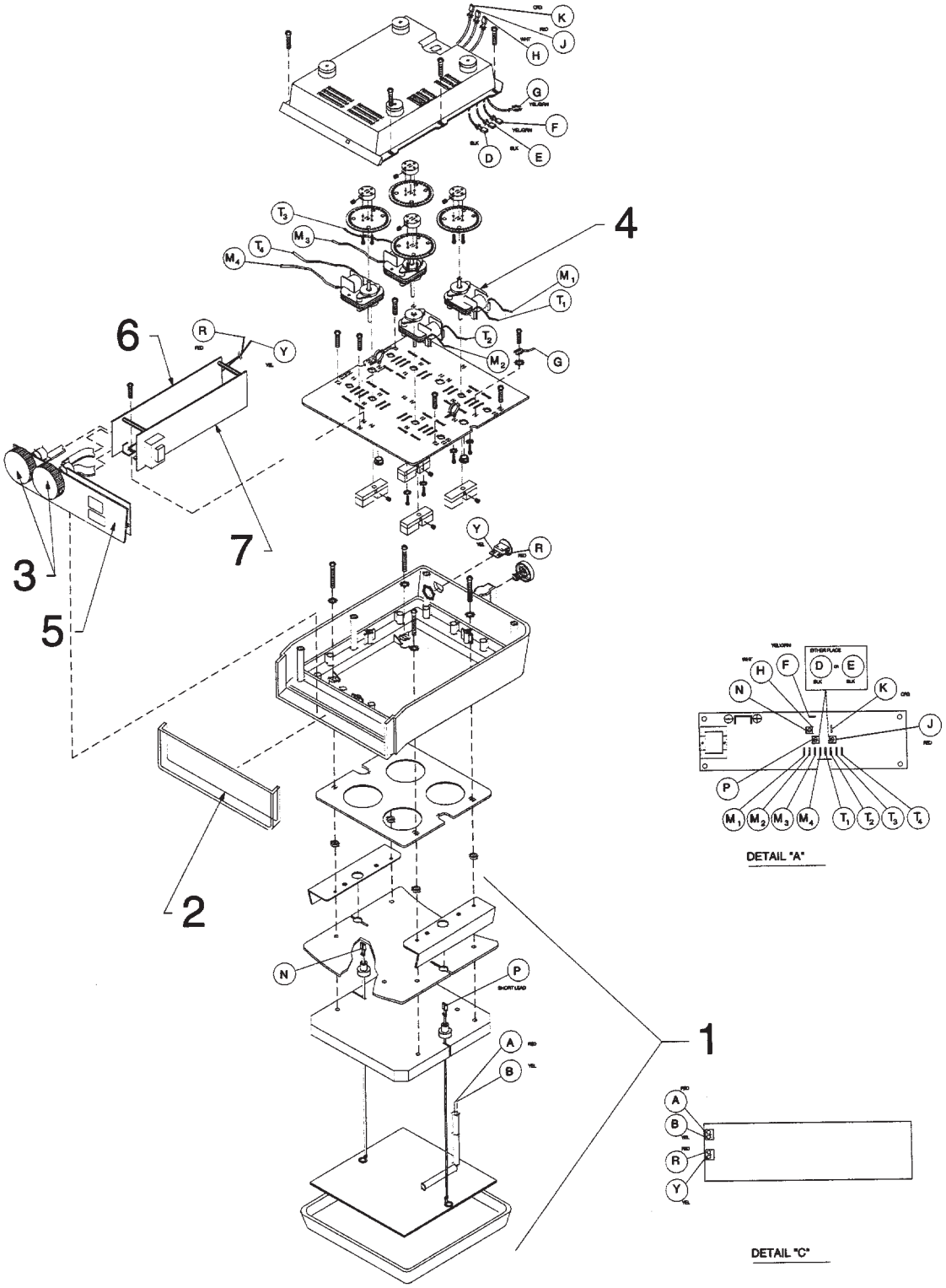
7. Unplug unit, turn unit upside down and remove screws from bottom. Move jumper J5 to J3. For series 732 units, replace jumper J4 if necessary.

Note
The Maximum error is ±10. Thus the correction must be between 340 and 360.

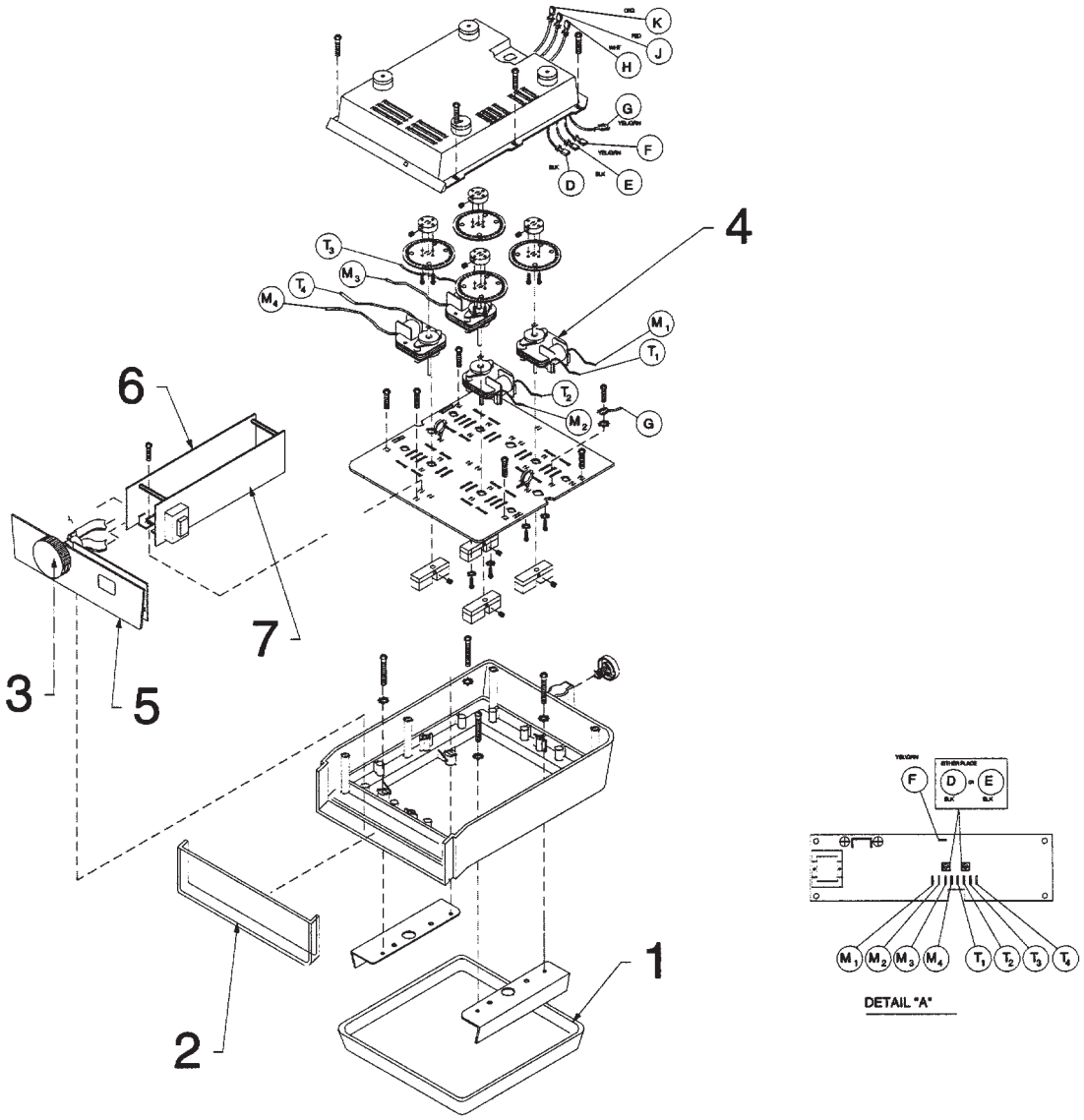
Troubleshooting

Problem	Solution
Unit is not operating at all.	Check power. Replace circuit breaker on power switch.
Unit is stirring or heating but no lights are lit on the display.	Check cable on display board.
Only the power light is lit on the display.	Check ribbon cable connection from the power board to the logic board. It may be upside down. Replace display board.
Some digits of the display are not lit.	Replace display board.
Display does not increase or decrease when knob is turned.	Check ribbon cable from knob to logic board. Replace ribbon cable from knob to logic board. Replace logic board. Replace encoder switch(es) on knob(s).
Speed or temperature display does not change when knob is pushed.	Check ribbon cable from knob to logic board. Replace logic board.
Unit does not stir.	Check to see if something is interfering with the motor, preventing it from spinning. Replace power board or logic board. Replace motor.
Unit does not heat.	Check heating element. If resistance across element is greater than 100Ω, replace element. Check connection of wires from element to power board. Check triac located on bottom cover of unit. Replace power board or logic board.
Display is reading erratic top plate temperature.	Replace top plate assembly.
Display is reading erratic solution temperature.	Replace probe.

Exploded Views



4-place Stirring Hot Plate



4-place Stirrer

Replacement Parts

To ensure your safety and for proper operation, the ceramic top plates for hot plates and stir plates are only sold as complete assemblies. This assembly includes the ceramic top, element, thermocouple, insulation, baffle plate and 2 ceramic top holders.

Key Number	Part Number	Unit Size	Unit Voltage	Description
1	EL732X1B	12”	120V	Stir Plate Top Assembly
	EL732X2B	12”	220-240V	Stir Plate Top Assembly
	EL732X3B	12”	208V	Stir Plate Top Assembly
	PT732X1	12”	100-240V	Stirrer Top Plate Only
2	CV730X2	12”	120-240V	Clear Plastic Cover
3	KBX727X1A	12”	120-240V	“Heat” Knob for heating units
	KBX727X2A	12”	120-240V	“Stir” Knob for stirring units
4.	MT847X1A	12”	100-120V	Motor (13” leads)
	MT847X2A	12”	100-120V	Motor (8” leads)
	MT847X3A	12”	208-240V	Motor (13” leads)
	MT847X4A	12”	208-240V	Motor (8” leads)
5	**Display Printed Circuit Boards: (Front of Unit)**			
	PC725X4A	12”	100-120V	Stirrers
	PC730X1A	12”	100-240V	Stir Plates
6	**Logic Printed Circuit Boards: (Center of Unit)**			
	PC731X4A	12”	100-240V	Stirrers
	PC732X2A	12”	208-240V	Stir Plates
7	**Power Supply Printed Circuit Boards**			
	PC731X1A	12”	120V	Stirrers
	PC731X2A	12”	220-240V	Stirrers
	PC731X3A	12”	100V	Stirrers
	PC732X1A	12”	120V	Stir Plates
	PC732X4A	12”	208V	Stir Plates
	PC732X3A	12”	220-240V	Stir Plates
Not Listed	**Additional Replacement Parts**			
	Part Number	**Unit Size**	**Unit Voltage**	**Description**
	SWX140	12”	100-240V	Front Switch
	SWX104	12”	100-240V	Circuit Breaker Switch Stirrers
	SWX141	12”	100-240V	Circuit Breaker Stir Switch Plates
	Accessory Thermocouple Probes: (Used with all voltages)			
	TC727X2	7.874” sheath	Teflon	For corrosive solutions
	TC732X1	6.000” sheath	Stainless steel	For general purpose use
	TC732X2	10.000” sheath	Stainless steel	For general purpose use
	Teflon Coated Stir Bar: (Used with all voltages)			
	ZSX65A	2” bar	Teflon coated	

Ordering Procedures

Please refer to the Specification Plate for the complete model number, serial number, and series number when requesting service, replacement parts or in any correspondence concerning this unit.

All parts listed herein may be ordered from the **Barnstead|Thermolyne** dealer from whom you purchased this unit or can be obtained promptly from the factory. When service or replacement parts are needed we ask that you check first with your dealer. If the dealer cannot handle your request, then contact our Customer Service Department at 319-556-2241 or 800-553-0039.

Prior to returning any materials to **Barnstead|Thermolyne Corp.**, please contact our Customer Service Department for a “Return Goods Authorization” number (RGA). Material Returned without an RGA number will be returned.

One Year Limited Warranty

Barnstead|Thermolyne Corporation warrants that if a product manufactured by **Barnstead|Thermolyne** and sold by it within the continental United States or Canada proves to be defective in material or construction, it will provide you, without charge, for a period of ninety (90) days, the labor, and a period of one (1) year, the parts, necessary to remedy any such defect. Outside the continental United States and Canada, the warranty provides, for one (1) year, the parts necessary to remedy any such defect. The warranty period shall commence either six (6) months following the date the product is sold by **Barnstead|Thermolyne** or on the date it is purchased by the original retail consumer, whichever date occurs first.

All warranty inspections and repairs must be performed by and parts obtained from an authorized **Barnstead|Thermolyne** dealer or **Barnstead|Thermolyne** (at its own discretion). Heating elements, however, because of their susceptibility to overheating and contamination, must be returned to our factory, and if, upon inspection, it is concluded that failure is not due to excessive high temperature or contamination, warranty replacement will be provided by **Barnstead|Thermolyne**. The name of the authorized **Barnstead|Thermolyne** dealer nearest you may be obtained by calling 1-800-446-6060 (319-556-2241) or writing to:

Barnstead|Thermolyne
P.O. Box 797
2555 Kerper Boulevard
Dubuque, IA 52004-0797
USA
FAX: (319) 589-0516
E-MAIL ADDRESS: mkt@barnstead.com

Barnstead|Thermolyne's sole obligation with respect to its product shall be to repair or (at its own discretion) replace the product. Under no circumstances shall it be liable for incidental or consequential damage.

THE WARRANTY STATED HEREIN IS THE SOLE WARRANTY APPLICABLE TO **Barnstead|Thermolyne** PRODUCTS. **Barnstead|Thermolyne** EXPRESSLY DISCLAIMS ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR USE.

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